

Sorption Cooling of Astrophysics Science instruments

Lawrence A. Wade

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, CA 91109

This paper presents the current status of both continuous and periodic operation sorption cryocooler development for astrophysics missions requiring cooling to 10 K and below. These coolers are uniquely suited for cooling detectors in planned astrophysics missions such as the Exploration of Neighboring Planetary Systems, the Next Generation Space Telescope, and Darwin. The cooler requirements imposed by these missions include ten year life and the ability to scale designs to provide only a few milliwatts of refrigeration while consuming only a few watts of input power. In addition, the EXNPS and Darwin missions add stringent requirements for mm-vibration and zero EMI/EMC operation.

Spaceflight test results are summarized for the Brilliant Eyes 4°-Kelvin Sorption Cryocooler Experiment. This periodic operation sorption cooler is ideal for applications that require only intermittent operation at 10 K with quick cooldown capability (under 2 minutes). The experiment successfully provided flight characterization of all sorption cooler design parameters which might have shown sensitivity to microgravity effects. Full ground test performance was achieved with no indications of microgravity induced changes.

Ground test results from a continuous 25 K cooler planned for use in a long duration airborne balloon experiment are also presented. This 25 K cooler, which is in final integration and test, can be used as an upper stage for a continuous 10 K sorption cooler. Similarly, the potential benefits of using a 10 K sorption cooler as an upper stage for a 4 K cooler are also described. Finally, a NASA program to develop 30 K, 10 K and 4 K vibration-free coolers for astrophysics missions is outlined; which is planned to start in FY 1997.